THE NEW POWER

An Expert Writes on Use of Compressed Air.

ADAPTED TO SURFACE TRANSIT

Its Numerous and Varied Advantages—Progress Made Within Past Few Years.

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(Mechanical and Electrical Engineer.)

During the last two or three years, the mechanical world has been much disturbed by the great advances made in motive power machines by the use of high pressure compressed air. We are all more or less familiar with what is termed "water" and its uses in general. For steam-power purposes, it is fed into a boiler and there, by the addition of heat, changed from a liquid fluid into a gaseous one; from a practically non-compressible substance into an elastic one, called "steam." In this last form, by reason of the heat it contains and the property of expansibility common to all gases, it is used to drive the engines that run our mills, our factories, our continent-spanning trains and the greyhounds of the ocean.

Air is also a gaseous fluid. It can be heated. Directly or indirectly by heat, it can be raised to any desired pressure. Thus it can be used in a manner similar to that of steam to drive machinery. Air, under high pressure, is far less dangerous in case of bursting of the containing vessel than is steam. It will escape from the rent in the vessel with a hissing sound, but no pieces of the vessel are projected as would be the case in a steam boiler explosion, where the sudden reduction of pressure causes the water to flash instantly into steam, increasing the volume more than one hundredfold. The scalding effect of steam, in the large majority of cases, causes greater injury than the direct effect of the explosion.

Compressed air has been used for more than a century to run machinery. It is used universally in mines for the running of pumping engines, hoists, rock drills, and underground locomotives. Here it has one great advantage over its two rivals, steam and electricity, that is, besides operating more economically, the air exhausting in the mine forms a most complete system of ventilation. For the running of large engines, such as pumps and mill engines, it is more economical than its rival, electricity, with its apparatus. One of the most notable long distance transmissions of air is that at the Chapin Mines, Iron Mountain, Mich. Here the water power afforded by the Quinessec Falls is made to develop two thousand horse power in compressed air. The air is led through three and one-half miles of twenty-four inch pipe to the neighborhood of the mines. Here smaller pipes are used to conduct it to the various mine shafts and the various machine shops belonging to the Company. The longest lead is about four miles, where it is used to drive a large Fraser & Chalmers pumping engine, capacity 2100 gallons per minute (approximately three million gallons per twenty-four hours) to a head of 1350 feet. An efficiency of more than 56 per cent is obtained at this mine with well designed engines, without any form of reheating device. This is all the more remarkable when it is taken into consideration that the air pressure at the air power plant is but sixty-two pounds, the air plant having been installed more than eighteen years ago. Were such a plant installed today, a pressure of not less than two thousand pounds per square inch would be used with a large gain in efficiency.

The question is often asked: "Why, then, if compressed air has been so successful, has electricity obtained such a foothold?" This can be very readily understood if one is familiar with capital. The large amount of money expended on the chimerical Keely motor is a matter of current history. When electricity first came into prominence, it was looked upon as almost a supernatural agent. It was predicted that there was nothing that could not be accomplished by its use. The electro-therapeutic crank called it "Fluid of Life," "Vital Force," and claimed it was the long sought for Cure-all. Large fortunes were made and lost on various electrical devices, both good and bad. It being something new, it became a fad. It has, however, reached a limit similar to that of steam. New discoveries in electricity are now few and far between. The efficiencies at first claimed by its use have failed to be verified and the world once more is looking for something better. Economy in operation, smaller cost of the coal pile, is now the cry of the progressive business man. To obtain the same is the aim of the inventor and the experimenter. Once more their attention is directed to gases. Probably the greatest field at present for the inventor is that of Auto-Mobile machines. Here the storage battery has to compete with the more perfect forms of gas engine and compressed air motor. It is a recognized fact that the system of independent motors is the one that eventually will be adopted. One great reason for this is that the machine will be free of losses due to transmission and can be operated as long as its charge lasts. The losses due to transmission are far greater in electric than in compressed air lines. There is one important difference between electricity and compressed air. In the transmission of a given power by electric efforts under a given pressure, the weight of copper will increase as the square of the distance, while with compressed air, the cost of the pipe will be directly proportional to the distance. In other words: one hundred miles of electric transmission would require ten thousand times the weight of copper of one mile, whereas, with compressed air, one hundred miles would require but one hundred times the cost of one mile for an equal transmission capacity of the pipe.

There are many points of resemblance, as well as difference, between electricity and compressed air that have not been generally known. It is a well known fact that for economical electric power transmission very high voltages must be used, say from ten to fifty thousand volts, and at the terminus, step-down transformers are required to bring the pressure down for safe distribution and use to five hundred volts or less. It was not until recently recognized that compressed air can be transmitted long distances economically only at high pressure, say of 2000 to 2500 pounds per square inch, and that it also must be reduced at the terminus to about 150 pounds, to be economically utilized in the various forms of air motors.

Nothing has been said above regarding the use of water power, which can be used to run either an electric generator or an air compressor. On account of the greater economy of compressed air transmission, it comes to the front not only as a competitor, but as an aid to electricity. If power cannot be transmitted long distances safely and economically by electricity, it can by air, and the power thus transmitted can be used locally to generate electricity for heat, light and other purposes and in addition, the compressed air can be used for refrigeration and ventilation.

On account of the vastness, it is impossible, in so few lines, to give more than a smattering of this subject. To make a scientific comparison would result in a large number of complicated formulas. Suffice to say that compressed air, like electricity, is successfully driving thousands of machines; but regarding economy, safety and simplicity of operation, compressed air is now in the ascendancy.

Statements have often been made that in Paris the compressed air system has proved a failure and that great losses had been sustained by the investors. This is not a fact, but allowing it to be so, the reply is that no one has a right to expect great success where the essential conditions in compressed air power transmission are violated. All attempts heretofore at power transmission have been made at low pressures of from 60 to 200 pounds per square inch, but as the loss of power in transmission under a given weight of air at 200 pounds, initial pressure, is ten times as great as if the pressure were 2000 pounds, it can readily be seen why great success has not hitherto been attained. Ignorance, prejudice, and the large amount of capital invested in electric manufacturing plants and apparatus have retarded the recognition and universal adoption of compressed air as the most economical and efficient agent for the propulsion of street cars and auto-mobiles for city and suburban service, as well as the transmission of power to great distances. It can be successfully demonstrated that the power actually utilized in foot pounds in the cylinder of an air motor, is largely in excess of the power expended in compression, and that air, under high tension, can be transmitted to very great distances with no diminution whatever in the amount of work that it is actually capable of performing. This last statement generally provokes a smile of incredulity, but the explanation lies in the perfection of the simple and efficient modern air reheater. The volume of one pound of steam at atmospheric tension is 26 cubic feet, hence when steam is used for heating the air, it adds more than 50 per cent to the volume of air admitted into the motor cylinder; but the air itself, by increase of temperature, is also expanded more than 50 per cent. Thus the volume of the air is increased more than 100 per cent at a temperature of 350 degrees. In other words: by the simple process of reheating, less than one-half the weight of air would do the work than if the air were used cold and dry. The cost of the reheating is trifling and requires but a few seconds.

Nearly all the large cities of the United States have witnessed the evil effects of the overhead electric trolley system. The beauty of their streets has been impaired. Loss of life and property has been great. Great expense has been incurred by the electrolytic (or eating away) action of the trolley currents upon the water and gas piping. Owing to the large amount of induction, the trolley system has greatly interfered with the efficiency of the telephone and telegraph systems. Inconvenience has been caused by an accident to the central power plant and by stoppages due to heavy rains and snows. With compressed air this is different. Each car, being an independent motor, has all the advantages claimed for the storage battery system with none of its disadvantages. It can travel on any street upon which a track is laid, or if off the track, it has power in itself to assist in retracking. It causes no evil effects on water and gas mains, telephone and telegraph systems. In case an accident should happen at the central power station, each car, being independent, can finish its round. A great many electric plants are now being supplied with storage batteries for the purpose of permitting the power plant engines to run at a comparatively constant speed, thereby gaining in efficiency of operation. The storage battery is expensive in first cost and expensive to keep in repair, requiring constant attention, replacing of plates and electrolyte. In compressed air, instead of the storage battery, there is simply supplied a large receiver consisting of steel tubes. The air compressor is run at a constant speed, pumping into this receiver. From this receiver the various cars take their charge. After once installed, there is no further bother with it. The electric power plant engines, during rain or snow, owing to the leakage from the trolley wires and other electric apparatus, are required to develop from one and one-half to three times the power that is required under good running conditions. With compressed air, practically no loss occurs with the exception of possibly a little slipping on the rails and the extra friction caused by snow. There are no losses whatever in transmission, as in the case of the trolley. A compressor is simply a pumping engine in which the fluid is air instead of water. The compressed air system can therefore be operated by the same class of men that can run a locomotive or a mill engine. The air motor on the air car is similar in design to that of a locomotive. Certainly no simpler device can be imagined than this, for one more easily kept in repair or less liable to get out of order.

The operation of an air car is much simpler than that of an electric car, it requiring but a slight motion of the wrist to bring the car from full speed to a dead stop. In an electric motor there is first to be operated an electric switch, and then the brake. This is one of the most important advantages of compressed air, inasmuch as there is less liability of damages resulting from injury to property and to life. This has been actually demonstrated by the air motor cars that were operated for one year on 125th St., New York City.

Electric people point out as a danger the high pressure carried in the storage tanks on the air cars. As already stated the bursting of one of these tanks will not throw any metal, and, unless a person was directly on the point of break, no harm would be done. Those who have seen men and horses burned to death by the breaking of a trolley wire, have not much to say regarding the safety of the trolley system. Furthermore, the rapid strides made in the perfection of the strength of materials has reached a very high point. Steel tubing is made by several large manufacturers in the world, the material of which is guaranteed to stand a test inside of the elastic limit of 4500 pounds, the bursting pressure being more than 9000 pounds. The pressure carried in street car work in these storage tubes is but from 2000 to 2500 pounds, giving a factor of safety of about four. Were water used under this pressure, the factor of safety should be greater because water is non-compressible. Air, however, being an elastic fluid, is entirely different and nothing can occur by its use similar to what is known as "water-hammer," or "hydraulic-shocks," occurring in use of water under pressure. There is not as much danger in using an air pressure of 2500 pounds, as there is in a boiler pressure of 120 pounds. One hundred and eighty pounds, steam boiler pressure, is being used in several of the pumping plants in these Islands.

The writer knows that there are movements on foot in several of the large cities towards the installation of air motors for city and suburban work and predicts that in less than three years the air car service will have strong public approval. It must be taken into consideration that there is a large amount of money at present invested in electrical equipment and that the cost to investors to change their present systems would be enormous. However, public sentiment and lower cost of operation will soon cause compressed air to be installed.

A point of advantage of the Hardie system of air cars is that the pound on the track is much less than for an electric motor of the same weight. This is due to the difference of the blow of a spring supported and of a rigidly mounted load. When passing over an obstruction one-eighth of an inch in height at a speed of ten miles per hour, the blow struck will be about seven times harder for an electric motor than for an air motor. Therefore, for the same weight of rail the streets of a city will not be disfigured as often in the case of the air system as with the electric.

There are several forms of air motors, the writer much preferring the Hardie on account of its mechanical simplicity as well as economy in operation.

To sum up tersely: It is an independent motor, under quick control, noiseless, at reasonable cost, of high efficiency, free from danger and objectionable features. It is the most economical system in cost of installation, operation, and maintenance. It has been thoroughly tested, both winter and summer, and is endorsed by many of the most prominent engineers in various parts of the country. It is for this reason that the writer, at the request of many friends, has written the above article in hopes that it may be of some assistance in determining for the people of Honolulu what street-car system they will eventually adopt.

H. A. ALLEN.

Mr. Allen is a graduate of Annapolis and is consulting engineer with Fraser & Chalmers, of Chicago.

A Cut Glass Present.

The members and officers of the Board of Health surprised their ex-president W. O. Smith yesterday. As a mark of their esteem they presented him with a beautiful cut glass punch bowl service. The offering was exquisitely fashioned and as a testimonial to show the cordial feeling held by the members and officers of the Board to the retiring official.

Told By the Sergeant.

From the Democrat, Grand Rapids, Mich.

At the Michigan Soldiers' Home, in Grand Rapids, lives Sergeant Richard Dunn, hale and hearty, although he carries the scars of several wounds received in some of the battles in the Civil War. In recounting his experience to a reporter, Mr. Dunn said:

"About a year and a half ago I began to have trouble with my stomach. My suffering was so intense that I tried different medicines and doctored with several physicians, but without permanent relief.

A Wounded Soldier.

"I read an account of Dr. Williams' Pink Pills for Pale People having cured a case much like mine and I decided to give them a trial, which I did.

"After taking five boxes I was cured. I never felt better than I do now, even in my younger days. I am naturally a robust man, but that stomach trouble, together with rheumatism, which afterward set in, were making fast inroads upon my health and I am satisfied that it would have been but a short time before my comrades would have been conducting the regulation funeral ceremonies over my remains, had I not chanced to read of and taken Dr. Williams' Pink Pills for Pale People.

"There are several others in the house who are taking these pills and are receiving great benefit."

RICHARD DUNN.

Subscribed and sworn to before me, this 1st day of November, 1897.

HENRY GIBSON, Notary Public.

Sergeant Dunn is perfectly willing that anyone should write him in reference to his case, provided stamp is enclosed for reply.

All the elements necessary to give new life and richness to the blood and restore shattered nerves are contained in a condensed form in Dr. Williams' Pink Pills for Pale People. They are also a specific for troubles peculiar to females, such as suppressions, irregularities and all forms of weakness. In men they cure cases arising from mental worry, overwork, or excesses of whatever nature.

Deputy Inspector of Schools T. H. Gibson, has returned from Maui.

TIMELY TOPICS

March 28th, 1899.

Our advertisements for the past month have been directed, generally, to the housewife, but we have things in our store that will be of interest to the wife as well as the husband. No doubt you heard about the runaway a few weeks ago. A man was riding down Fort street, his horse suddenly got frightened at some object, became unmanageable and started to run away. The man tried every effort to check the horse, but without avail. A man happened to be coming up the street on his bicycle and before he could get out of the way, the horse, vehicle and all were upon him. The bicyclist was seriously hurt and was confined to his bed for some time. Now who do you think is to blame for that accident? We blame the driver, as he should have had one of